

VIII. *Remarks upon the Homologies of the Ovipositor.*
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READING in the Proceedings of the Society (Proc. Ent. Soc. 1867, p. lxxxv), that the Homology of the Ovipositor formed the subject of a discussion at the April meeting of 1867, and seeing that no definite conclusion was arrived at upon the matter, I have ventured to put together a few observations relating to the question, hoping that they may go a little way towards its solution.

I shall take as a criterion the ovipositor of the adult *Agrion*, because in this genus, the elements composing that organ remain free during the whole course of their development. There are three pairs of these elements in *Agrion*. One pair constitutes the terebra, the next the inner valvulæ, the third the outer valvulæ, otherwise called the valvulæ vaginales. The terebra is formed of long ensiform pieces, (*ogdo-tergo-rhabdites*, Lacaze-Duthiers) denticulated towards the apices, which arise from the middle of the posterior edge of the eighth abdominal ventral arcus. It produces a somewhat carinate ridge on the under-surface of the apparatus. From behind and above it, near the centre of the base of the ninth abdominal ventral arcus (*sternite*, Lac.-Duth.) spring the linear inner valvulæ, (*ennato-sterno-rhabdites*, Lac.-Duth.). Exterior to these, from a longitudinal base, and from the same segment, the lamelliform, truncate, and slightly appendiculated valvulæ vaginales (*ennato-episternites*, Lac.-Duth.) grow out: these with the terebra enclose the inner pair. [I drew up this description, and those afterwards given, from moistened cabinet specimens.] In *Calopteryx* and *Libellula* the inner valvulæ are sub-obsolete, if not entirely suppressed.

The egg-valve of certain *Ephemeridæ* is not specially homologous with any of the elements of the ovipositor of *Agrion*. It is just possible that it may exhibit the same general homology as the terebra; for in *Leptophlebia vespertina*, Lin., (*cincta*, Retz.), it is merely a minute projection from the middle of the apical border of the seventh ventral arcus. Its special homologue seems to be a production from the lamina subgenitalis of *Deti-*

cus. In *Baëtis*, † Burm., and in *Baëtis*, Leach, the egg-valve takes the form of an entire membrane, and arises from an extensive transverse base; the same organ is bifid in the subgenus *Cloëon* of the genus *Baëtis*, Leach. Its serial homologue is the "last ventral plate" of *Baëtis*, † Burm., and the so-called "egg-valve" of *Potamanthus* (*Leptophlebia*) of Dr. Hagen's Synopsis of the British *Ephemeroïdæ*.

Of the *Orthoptera* possessing the ovipositor *Deticus verrucivorus*, Lin., may be taken as an example. In this insect the instrument in question seems at first sight to be simply bivalvular; but upon a close inspection each valve is found to be made up of three elements intimately adhering to one another. On dividing the lamina subgenitalis longitudinally it will be seen that the first pair of elements proceeds from the middle of the apex of the eighth ventral arcus; this pair (*ennato-tergo-rhabdites*, Lac.-Duth.), is therefore specially homologous with the terebra. The remaining pairs, the valvulæ vaginales externæ (*ennato-episternites* and *ennato-sterno-rhabdites* anchylosed, Lac.-Duth.), and valvulæ internæ (*ennato-sternites* or *gorgerets*, Lac.-Duth.), maintain positions with respect to the first pair and to each other corresponding with those occupied by their special homologues in *Agrion*. Being more intimately adherent to the outer valvulæ than the terebral elements, and being moreover covered by them, the inner valvulæ are demonstrated with greater difficulty than the other pairs of elements. Their limits are however indicated by a shallow groove which runs almost to the acute apex of each outer valvula on the inner side; and on cutting across the valves each element seems to be provided with a special tracheal tube. As Fischer (*Orthop. Euröp.* p. 21) ascribes a simple bivalvular ovipositor to *Rhaphidophora cavicola*, Kol., it may be surmised that a more complete union obtains between its components, than is arrived at in *Deticus*.

It is not possible at present to determine exactly the homologies of the ovipositor of *Hymenoptera* in every family, because the mode of its development has not yet been observed with sufficient care (so far as I am aware) in any group other than the *Aculeatu*. In describing the *sting* I shall employ the terms used to denote the

† This symbol distinguishes a misapplied name. I propose to call this genus *Ecdyonurus*. Type, *E. venosus*, Fabricius.

parts of the, in some degree, homologous organ of the *Ichneumonidæ*. According to Mr. Packard,* during the semi-pupa stage of the development of *Bombus*, the first two pairs of elements arise in juxta-position from the eighth abdominal ring; whilst the third pair is given off from the apical edge of the ninth ring: and at this period they are in the form of slender non-articulated tubercles. The two outer pairs ultimately ensheath the inner pair completely. From this it appears that the spiculæ filamentosæ (*ennato-tergo-rhabdites* or *stylets*, Lac.-Duth.), which lie in the groove of the acus (*gorgeret* or *ennato-sternite*, Lac.-Duth.), homologize specially with the terebral elements of *Agrion*. Unfortunately it is not stated in the Annals of Natural History (*loc. cit.*) what becomes of the remaining pairs of elements: so that whether they become anchylosed together so as to form the acus (an event not altogether incompatible with its anatomy), or whether, on the other hand, the second pair cohere to form the acus, and the third pair maintain their distinctness under the form of the ovipositor, is a matter of uncertainty. On the earliest opportunity I will make the observations necessary for the decision of this question. Meanwhile it is clear that neither of them is specially homologous with any of the elements of the ovipositor of *Agrion*, and that the third pair of elements presents the same general homology as the terebra, whether it forms a part of the acus, or whether (as I am inclined rather to believe) it is the ovipositor.

In short it may be regarded as certain that the Aculeus of *Hymenoptera* and the Ovipositor of *Agrion* have very little in common with one another. Indeed so different are they that it might almost be regarded as an impropriety of language to say that the one is a modification of the other. The number indeed of their components is identical, but in scarcely anything besides the number of their constituents can it be said with M. Lacaze-Duthiers that "*les tarières des Névroptères sont semblables aux tarières des Hyménoptères.*"—(Ann. Sc. Nat. Fr. 1853, tom. xix. p. 30).

In his elaborate and most valuable "*Recherches sur l'Armure Génitale Femelle des Insectes,*" (Ann. Sc. Nat. Fr. 1849-1853), the author just named upheld the hypothesis

* An abstract of Mr. A. S. Packard's paper, On the Development and Position of the *Hymenoptera*, is given in Ann. and Mag. Nat. Hist., 3rd ser., vol. xviii. p. 82, et seq.

that the elements of an abdominal segment enter into the composition of the ovipositor. And Mr. Bates inquired at the April meeting of 1867, whether the ovipositor was not a modification of an abdominal segment. (See Proc. Ent. Soc. 1867, p. lxxxv). The observations of Mr. Packard, cited above, both invalidate that hypothesis and answer this question in the negative. He says that in the semi-pupa stage of the development of *Bombus* the elements which go to form the aculeus lie in three separate pairs, and in two groups, in the form of slender non-articulated tubercles, arising on each side of the mesial line of the body. (The elements of the segments from which the components of the aculeus grow out being gradually reduced in size, ultimately become the chitinous basal supports of that organ.) Now where a segment is derived from a pre-existing segment, it is formed by a transverse division of that segment, and not by the coalescence of various outgrowths from that segment. Therefore the development of the elements of the Aculeus and the Ovipositor proceeding in a manner different from that of the elements of a segment, those cannot be in any degree homologous with these.
